

Claims

- [c1] A method of maintaining phase-matching criteria of an acousto-optic device during temperature variations, the method comprising:
- a) measuring a temperature of the acousto-optic device;
 - b) generating a control signal in response to the measured temperature; and
 - c) changing a frequency of a signal applied to an acoustic wave transducer positioned in the acousto-optic device in response to the control signal, the frequency of the signal being chosen to maintain the phase-matching criteria of the acousto-optic device.
- [c2] The method of claim 1 wherein the measuring the temperature of the acousto-optic device comprises directly measuring a temperature of the acousto-optic device.
- [c3] The method of claim 1 wherein the measuring the temperature of the acousto-optic device comprises directly measuring a temperature of an acousto-optic substrate in the acousto-optic device.
- [c4] The method of claim 1 wherein the measuring the tem-

perature of the acousto-optic device comprises indirectly measuring a temperature of the acousto-optic device.

- [c5] The method of claim 4 wherein the indirectly measuring the temperature of the acousto-optic filer comprises measuring a delay time of an acoustic wave propagating between a first transducer and a second transducer in the acousto-optic device.
- [c6] The method of claim 1 wherein the measuring the temperature of the acousto-optic device comprises measuring a temperature at a plurality of locations in the acousto-optic device to determine an average temperature.
- [c7] The method of claim 1 wherein the control signal is a function of the measured temperature of the acousto-optic device and a wavelength that corresponds to the phase-matching criteria of the acousto-optic device.
- [c8] The method of claim 1 wherein the signal applied to the acoustic wave transducer maintains the phase-matching criteria when a birefringence in at least one optical waveguide in the acousto-optic tunable device changes.
- [c9] The method of claim 1 wherein the signal applied to the acoustic wave transducer maintains the phase-matching criteria when a speed of sound in at least one optical

waveguide in the acousto-optic tunable device changes.

[c10] An acousto-optic tunable device comprising:

- a) an acousto-optic substrate;
- b) an acoustic wave transducer positioned on the acousto-optic substrate;
- c) a temperature sensor that is positioned in thermal communication with the acousto-optic substrate, the temperature sensor generating an electrical signal at an output that is related to a temperature of the acousto-optic substrate;
- d) a processor having an input that is electrically coupled to the output of the temperature sensor, the processor generating a control signal at an output in response to the electrical signal generated by the temperature sensor; and
- e) an oscillator having a control input that is electrically coupled to the output of the processor and having an output that is electrically coupled to the acoustic wave transducer, a frequency of the oscillator being changed in response to the control signal in order to maintain phase-matching criteria of the acousto-optic tunable device as the temperature of the acousto-optic substrate changes.

[c11] The acousto-optic tunable device of claim 10 wherein the acousto-optic tunable device comprises an acousto-op-

tic tunable filter.

- [c12] The acousto-optic tunable device of claim 10 wherein the temperature sensor is positioned proximate to the acousto-optic substrate.
- [c13] The acousto-optic tunable device of claim 10 wherein the temperature sensor is embedded in the acousto-optic substrate.
- [c14] The acousto-optic tunable device of claim 10 wherein the temperature sensor is chosen from the group comprising a thermocouple, a thermistor, and a semiconductor junction.
- [c15] The acousto-optic tunable device of claim 10 wherein the temperature sensor measures an average temperature of a portion of the acousto-optic substrate.
- [c16] The acousto-optic tunable device of claim 10 wherein the oscillator comprises a voltage controlled crystal oscillator (VXCO).
- [c17] The acousto-optic tunable device of claim 10 wherein the oscillator comprises a digital frequency synthesizer.
- [c18] The acousto-optic tunable device of claim 10 wherein the control signal is a function of the temperature of the acousto-optic substrate and a desired phase matching

wavelength of the acousto-optic tunable device.

[c19] The acousto-optic tunable device of claim 10 wherein the frequency of the oscillator is changed in order to maintain the phase-matching criteria when a birefringence in at least one optical waveguide in the acousto-optic tunable device changes.

[c20] The acousto-optic tunable device of claim 10 wherein the frequency of the oscillator is changed in order to maintain the phase-matching criteria when a speed of sound in at least one optical waveguide in the acousto-optic tunable device changes.

[c21] A device for maintaining phase-matching criteria in an acousto-optic device during temperature variations, the device comprising:

- a) means for measuring a temperature of the acousto-optic device;
- b) means for generating a control signal in response to the measured temperature; and
- c) means for changing the frequency of a signal applied to an acoustic wave transducer positioned in the acousto-optic device in response to the control signal, the frequency of the signal being chosen to maintain the phase-matching criteria of the acousto-optic device.

